Hardware/Software Codesign

SS 2010

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Overview

• Introduction and motivation
• Course synopsis
• Lecture organization
What is HW/SW Codesign?

... integrated design of systems that consist of HW- and SW-components

- Analysis of HW/SW boundaries
- Evaluation of design alternatives
Hardware/Software Boundaries

• General purpose systems (PC, workstation)
  – processor design:
    processor ———————> compiler, operating system

• Embedded systems (cell phone, automotive electronics)
  – design of specialized processors:
    processor ———————> compiler
  – system design:
    processors ———————> dedicated hardware devices
Why Codesign? (1)

• Modern embedded systems require “design” optimization
  – many functions, great variability, high flexibility
  – heterogeneous target systems
    ▪ processors, ASICs, FPGAs, systems-on-chip, …
  – many design goals
    ▪ performance, cost, power consumption, reliability, …

• Advances in formal / automated design methods
  – automation on the system level becomes possible
  – reduction of cost and time-to-market
Why Codesign? (2)

- Optimization of the “design process”
Word Game: CO-design

- komplex
- nebenläufig
- gemeinsam
- korrekt
- koordiniert
Course Synopsis

- System design – models and methods
- Target architectures for HW/SW systems
- Compiler and code generation
- Architectural synthesis
- System partitioning
- Estimation of design parameters
- Further codesign topics
  - Interface- and communication synthesis
  - Emulation and rapid prototyping
  - HW/SW co-simulation
**Preview: Target Architectures**

- *general-purpose processors*
- *field-programmable gate arrays*
- *microcontrollers*
- *digital signal processors*
- *systems on a chip*
\[ x := a \times b - (c+d) \times e \]

- register selection
- instruction selection
- instruction ordering

lw r1,a
lw r2,b
mul r1,r1,r2
lw r2,c
...
i705 (Palm)
Benefits? Learn about …

• ... challenges and approaches in modern system design
• ... target architectures – device zoo
• ... useful optimization methods
• ... a current research area
Lecture Organization

• Lecture  Thursday, 9:15-10:45, D2
• Exercises  Thursday, 11:15-12:45, D2
  – download the exercise sheets and try to solve the problems
  – discussion of the problems in the class
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• Course Materials on the web
  – slide copies, exercise sheets
  – script, papers